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ABSTRACT

This study sought to determine if success and continuance in an accelerated high school mathematics program could be predicted, and which identifying tools would best accomplish this purpose. The sample consisted of 72 tenth- and eleventh-grade students in one high school who were either identified for acceleration or had accelerated on their own. A multiple regression analysis with 21 variables indicated that math 7-8 grades and algebra grades had the highest correlation with both success and continuance in the program. Best for predicting success in accelerated math 7-8 was the combination of Iowa test mathematics total score, sixth-grade mathematics grade, age, and Iowa test total score. Continuance was not significantly predictable unless the math 7-8 grade was used. A class identified during seventh grade had fewer dropouts, while the group that accelerated on their own were 88% boys. It was concluded that if twice as many students were selected to take a math honors course in seventh grade, selection for accelerated eighth-grade algebra could be made using the math 7-8 grade and the maturity of an additional year. A new prediction model for use in the school district was presented for consideration. (Author/MNS)

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IDENTIFYING MATHEMATICALLY TALENTED SIXTH GRADE STUDENTS IN AN UPPER-MIDDLE INCOME COMMUNITY

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A Thesis Presented to the Graduate Faculty

of

California State University, Hayward

In Partial Fulfillment

of the Requirements for the Degree

Master of Science in Education

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IDENTIFYING MATHEMATICALLY TALENTED SIXTH GRADE STUDENTS IN AN UPPER MIDDLE INCOME COMMUNITY

By

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Approved: Date:

Donald J. Brown July 27, 1983

Thomas E. Whalen July 27, 1983

ABSTRACT

The purpose of this study was to determine if success and continuance in an accelerated high school mathematics program could be predicted, and which identifying tools would best accomplish this purpose. Using a sample group of 72 10th and 11th grade students attending Piedmont High School, who were either identified for acceleration or had accelerated on their own, a descriptive and correlational study found the relationships between success and continuance in high school mathematics and the possible identifying variables.

A multiple regression analysis found that of the 21 variables used, math 7-8 grades and algebra grades had the highest correlation with both success and continuance in the program. Of the identifying tools available to 6th grade teachers for selection of accelerated math 7-8, the best predictor for success was the combination of Iowa math total score, 6th grade math grade, age and Iowa test total score. Continuance was not significantly predictable unless the math 7-8 grade was used. Additionally, it was found that a class identified during 7th grade had fewer dropouts. The group that accelerated on their own were 88% boys.

It was concluded that if twice as many students were selected to take a math honors course in 7th grade, selection for accelerated 8th grade algebra could be made using the math 7-8 grade and the maturity of an additional year. A new prediction model for use in the Piedmont High School District was presented for consideration, and implications for predicting mathematics success in general were discussed.

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Chapter 1

INTRODUCTION

Proper identification of talented children could improve the education of many students. Marland, the U.S. Commissioner of Education, reported in 1972 that several studies cited a high percentage of gifted students among school drop outs. This was a result of being unchallenged and victims of egalitarian attitudes, conformity of thinking, and uniformity of behavior (Alvino & Weiler, 1979; Rice, 1980). Fox wrote in 1979 that 1/5 of the nation's children were bored and frustrated. Although some like school, the highest SAT scores correlated with more dislike of school (Keating, 1974). McWilliams cited Robert Browning who said, "a mathematically precocious youth's reach should exceed his grasp, or what's an educational system for?" (1976, P. 53).

For the above reasons, there has been a renewed interest in the gifted and talented. Most noteworthy was the passage of the Gifted and Talented Children's Act (P1 95-561) in 1978. The purpose of this act was to provide monies for an appropriate education for gifted and talented students. Gifted and talented youngsters were defined as students who were two standard deviations above the mean in intelligence, creativity, specific academic fields, leadership, high achievement, visual or performing arts, or any other talent.

In 1980, the national budget for the gifted and talented was

doubled to $6.28 million plus $10 million from other agencies and $100 million from state funding. Yet nearly one billion dollars was spent for culturally disadvantaged, physically handicapped and learning disabled (Rice, 1980).

With 2½ million gifted school age children in the United States, there is a continued need for more accelerated and enriched programs. Accurate identification for these programs is one of the most important ingredients for providing an appropriate education.

Background of the Problem

Concern for more able students began in 1868 when William T. Harris instituted flexible promotion in the St. Louis schools. In the 1900's New York City schools had rapid advanced classes. By 1915 New York had special classes that completed grades 7, 8, and 9 in two years (Passow, 1979). Special schools were established for high level ability students. Bronx High School of Science, still in existence today, is such an example (Keating in Passow, 1979).

In the 1920's Terman began his longitudinal genetic studies of 1,528 persons with IQ's above 135. His study resulted from the need to know how to educate gifted students (Goleman, 1980; Passow, 1979).

The decade of the 50's brought interest in creativity and its relationship to giftedness. Torrance designed tests of creativity.

Guilford introduced a Structure-of-intellect model. Intellect was viewed as multi-faceted. Divergent thinking was defined and valued (Greenes, 1981). In 1959 the Ford Foundation awarded money to the gifted program in Portland. A new broader definition was used to define gifted and included the top 10% of the most intellectually talented (Passow, 1979).

There was pragmatic interest in the mathematically and scientifically talented in the early 1960's (Rice, 1980). The Russians had launched Sputnik. The era of New Math began. The acceleration of high school mathematics by one year became popular. The emphasis was on the needs of society, however, not on the concern of the talented student (Warner, 1977).

This interest in the mathematically talented student was shortlived. A mood of egalitarianism prevailed during the late 60's and early 70's. The too smart child was resented; the advocacy by the parents of gifted children was seen as pushy (Clayman & Whitmore, 1979). It was assumed that bright children achieved to their potential no matter how they were taught (Clayman & Whitmore, 1979). Education was concerned with self-image; acceleration was equated with application of pressure. Individual differences were minimized. Gifted courses eroded away in many shcools. A philosophy of egalitarianism in the educational system obstructed special programs for the gifted (Khatena, 1976).

In the 80's it is again felt that the most appropriate education

for each individual is the most desirable. Recent research has been concerned with the best way of providing this appropriate education.

In mathematics, for several reasons, there is an increased feeling of urgency about effective education for the mathematically talented. First, quantitative tests can identify and predict the success of these students in future math courses with good validity (Anastasi, 1982). Secondly, mathematics has a sequential nature to its content and learning can be easily accelerated. Thirdly, and probably most important, technology in the fields of math and science is advancing at a fast pace. Ideally, therefore, it is espoused that students should be presented new material at a rate commensurate with their rate of learning. Keating (1979) stated that gifted and talented youth learned and dealt with new information at a rate 50-75% faster than the average student.

Statement of the Problem

The purpose of this study was to analyze and propose the best criteria for identification of mathematically talented sixth grade middle school students in an upper-middle income community.

Schools have found that the easiest way to provide an appropriate education for mathematically talented youth is to combine seventh and eighth grade mathematics into one year during the seventh grade. Then pre-calculus courses are taught sequentially beginning with algebra in the eighth grade. This creates a minimum

of programming difficulties. The seventh and eighth grade student is usually in a middle or junior high school where the student is well known by teachers and counselors. The educational philosophy at this level is one of nurturing of the individual child and growth toward potential.

Acceleration in the elementary grades is considered to be less desirable. Often elementary teachers are not trained to teach higher mathematics. The elementary school child is encouraged to develop in many areas and acceleration in one subject might discourage maximum growth in another area.

It follows, therefore, that one of the most important aspects for providing an appropriate education to mathematically talented students is the identification of these students in sixth grade. Accurate identification procedures are needed to place each qualified student into an appropriate accelerated program.

Significance of the Problem

Before researching identifying procedures for mathematically talented youth, the significance of these procedures in the context of providing an appropriate education should be stated. For purposes of this study an appropriate education for mathematically talented students is one that is challenging and allows them to learn at their natural rate. The education must provide each student with the chance to reach his/her potential in mathematics. An unidentified student is less apt to receive an appropriate education.

A study in 1976 surveyed 120 schools and found that gifted programs were perceived to be hard to justify. The needs of other students appeared so great there wasn't energy or time left to program for the gifted (Williams & Oliver. 1976). Trafton (1981) termed it a decade of neglect for the gifted. He emphasized the need to identify and plan for effective programs.

Whitmore said that the gifted were only identified and attended to if there was a societal need for social and scientific leadership. She attributed the present national interest to the need for effective leaders in math and science (Clayman & Whitmore, 1979). Olstad argued that gifted programs were not elitist (1981). He stated that everyone had a right to try out for the team but not be on it.

Emphasis should be placed on the needs of the individual when identifying the talented mathematics students. The benefits to society should be a result not a reason for special attention (Olstad, 1978). The 1958 Rockefeller Report on the Pursuit of Excellence says:

> Democracy is not to be conceived of as an invitation to share a common mediocrity, but as a system that allows each to express and live up to the special excellence that is in him (Olstad, p. 188).

It is important to correctly identify and provide services for the

gifted and talented that will enable them to contribute to themselves and to society (Warner, 1977).

In addition to the right of each individual to an appropriate education, there has been an urgency to prepare students for their future. Research done on Terman's gifted sample showed that the best early predictor for career oriented women as early as the 1930's was having special mathematical ability as children (Goleman, 1980). Gallagher (1975) said that society was moving so fast it was impossible to teach for tomorrow's jobs. Bright students, in particular, have a more urgent need to learn problem solving as opposed to problem stating. Guilford's (1975) goal was to help foster creative problem solvers; he feared this was too often not happening. Consuegra (1982) stated that students of the 1980's were living in the most technologically advanced and complex society of all times. He noted that talented students will contribute to the base of knowledge before they leave school.

Lastly, mathematically talented who have been correctly identified and successful in special programs constitute one of our nations most precious resources (Fox, 1979; Stanley, 1981). There is a need for the greatest minds in our country to develop their talents to whatever extent they can (George, Cohn, & Stanley, 1980). It is important to develop the skills of scientific inquiry and creative self expression in the talented youth (Clayman & Whitmore, 1979). It may be a gifted student who unlocks the secrets to

educating our disabled students (George et al., 1980) or finds the cure to cancer (Clayman & Whitmore).

Chapter 2

A REVIEW OF THE LITERATURE

Introduction

Researchers agree that it is very difficult to correctly identify all the potentially gifted students (Rice, 1980). Characteristics of genius are elusive. A newspaper editor fired Walt Disney because he had no good ideas. Einstein didn't speak until 4 years old or read until 7 years. Beethoven's music teacher said of him, "as a composer he is hopeless" (Rubenzer, 1979). There is heterogeneity even among precocious youth (Keating, 1974).

Recent research has tested empirically the best methods for identifying mathematically talented students. Increased knowledge in computer technology of research has been responsible for new ways to analyze effectiveness of identification processes. The field of knowledge has been significantly increased by the Study of Mathematically Precocious Youth (SMPY). This 11 year old program at Johns Hopkins University was based on Julian Stanley's philosophy that for highly precocious youngsters acceleration was preferable to most types of enrichment, especially in math and math related subjects (1976a). Students in the top 1 to 2% nationally have been researched in the context of accelerated content and fast-paced pre-calculus math.

When identifying the mathematically talented it is necessary to understand both the child and the identifying tools. This

review of the literature will cover first the intellectual and personality traits of the mathematically talented child. Then research on the tools used for identifying these students will be reviewed.

The Mathematically Talented Child

Understanding talented children involves recognizing their learning characteristics and modes of thinking (Renzulli, 1981; Trafton, 1981). Often too much emphasis has been placed on testing knowledge and not on the process of thinking (Rice, 1980). Talented children also exhibit specific personality characteristics that need to be understood by the person identifying mathematically talented youth. The intellectual and personality traits follow.

Intellectual Traits

Renzulli and Hartman (1981) found mathematically talented students showed above average ability, total commitment and/or high levels of creativity. Whitmore listed propensity toward self-learning, curiosity, skillful problem solvers and advanced mental abilities as characteristics (Clayman & Whitmore, 1979). Exceptional verbal and reasoning capabilities, well developed powers of abstraction and the willingness to take risks in the exploration of new ideas were further characteristics (Greenes, 1981). More craving for knowledge, ability to concentrate (Olstad, 1978), and orientation toward task (Getzels and Jackson, 1981) were noted.

The literature indicated that talented youngsters were producers

and not merely consumers of culture. They didn't just consume facts in school but had new concepts, divergent approaches and creative solutions (Passow, 1981). They operated at Piaget's formal operational level earlier than their peers (Consuegra, 1981). Otey (1978) felt they were consistently superior in school but that their divergent thinking explained their unconventional responses to conventional tasks.

Keating (In George et al., 1980) felt that it was the rate at which they could acquire and integrate new information that was the distinguishing factor. They remembered, organized, retrieved, and applied vast amounts of information (Clayman & Whitmore, 1979). They learned a higher density of subject matter per time unit. They took 50 to 75% less time than the average (Keating). SMPY has repeatedly found 7th grade students who can pass a first year algebra final without having taken the course. This natural acceleration has come from great math reasoning ability and independent study at home in both systematic and unsystematic ways (Fox in George et al., 1980).

Another study found the learning styles of the gifted to be significantly different ($\leq .001$) from the non-gifted. The gifted preferred visual, tactile or kinesthetic learning to auditory; were less teacher motivated, more self motivated; were persistent; preferred to learn alone rather than with peers or adults; and preferred some sound to quiet while studying (Griggs & Price, 1980).

All talented mathematics students may not have all the identifying traits. Payne (1981) found in particular that some students at a higher level of cognitive thinking had the traits mentioned above but did not excel in computation.

Studies showed that potentially top students divided into two major categories; (1) the intellectually superior person who was self-motivated, worked to potential and was a conforming good student; or (2) the intellectually superior or creative child who was gifted on one or two special areas, but was not interested in or challenged by school necessarily, and did not have necessarily good study habits (Dirks & Quarfoth, 1981).

Research done with the SMPY students listed similar characteristics to those above (Consuegra, 1982; Keating, 1974). See Appendix A. Renzulli and Hartman (1981), recognizing the importance of the use of the above learning behavior traits, published a Behavior Traits Rating Questionnaire to be filled out by teachers and used in the identification of talented students. See Appendix B.

Personality Traits

Psychologists have studied personality characteristics of the gifted. In the 1930's Louis Terman found them to be healthier, more personally attractive and better coordinated than the average (Goleman, 1980). Gowan found talented students to have a high level of energy, confidence and a permissive value structure (Rubenzer, 1979).

Stanley (1976) found that students who had accelerated by their own choice tested as emotionally and socially stable persons on the California Personality Inventory (CPI). Their profile appeared more like the bright persons several years older than like their own age-mates.

Some talented students had average behavior and did not stand out. Some had learned to conform. Some had just "pieces" of high intellect (Otey, 1978). Olstad (1978) stated that achievement was a result of maturity.

Few, if any, talented students possess all the above traits. It is the variation of combinations of the many characteristics that makes it difficult to devise a uniform formula for identifying talented math students. Parents, peers, student self-evaluations and teachers can contribute to assessment of personality traits.

Tools for Identifying the Mathematically Talented

Many researchers have looked for an easy, inexpensive, and reliable tool to identify talented mathematics students. As the following will illustrate, there has been a difference of opinion as to the best method. Each type of identifying tool is studied separately below.

Individual Tests

Hirsh & Hirsh (1980) wrote that the best single method for identification of the gifted was the standardized individual intelligence test. The WISC-R was highly thought of and had the

advantage of the separate subtests for specific types of thinking (Krichev, 1975; Rubenzer, 1979).

In 1971 U.S. Office of Education Study reported that individual tests were better than group tests for the gifted. It stated that as many as 50% of all gifted children could go unidentified if group tests alone were used (Alvino & Wieler, 1979). The two types of testing were compared and the difference between the two increased in proportion to the level of intelligence, which illustrated that the gifted were most penalized on group tests (Alvino & Wieler, 1979).

A limitation of individualized testing was the expense in time and service of the psychologist (Hirsch & Hirsch, 1980). Researchers have tried to find a short-form intelligence test to use as a reliable inexpensive method of screening bright math students.

A study showed that the Ammons Quick Test only identified 23 of 57 gifted and should not be used (Hirsch & Hirsch). The WISC Digit Span subtest had no significance as a diagnostic tool (Schoonover, 1975). The Block Design subtest of the WISC correctly selected 47 of 58 known gifted students who had shown a preference to being taught through non-verbal means (Beckman, 1979).

Research of different combinations of subtests of the WISC-R has found several valid predictors of the Full Scale score. Killan and Hughes (1978) found a correlation of .92 with the Vocabulary-Block Design dyad. The combination of Similarities-Vocabulary-

Object Assembly identified 11 of the 12 children known to have Full Scale WISC-R IQ's in the gifted range (Dirks, Wessels, Quarfoth, & Quenon, 1980). The tetrad of Similarities-Vocabulary-Block Design-Object Arrangement was the most efficient short form in terms of time and reliability found by Karnes and Brown (1981). ($r > .7336$) It was believed that the similarity between the Block Design test and a commercial game "Trac 4" reduced the previous validity of this test (Dirks et al., 1980).

The highly gifted hit ceilings and near ceilings on important subtests of the WISC-R (Lucito & Gallagher, 1960). Their true score was often above the ceiling (Keating, 1975). There was a need for harder tests (House, 1981 b; Keating, 1975). An 8th grade test ceiling was too low for gifted middle school students. They needed a test for high school or college (House). To use the 98th or 99th percentile for identification was understandable but not justifiable. A test was not reliable in the top percentiles. The different abilities among the students could not be accurately identified (Keating).

Group Tests

Unless students have been individually tested in the early grades, it appears that it is costly and not reliable to test them individually when they become Middle School age. Group tests are more often used for this age according to the literature.

A study found that the math subtests of the CTBS (Comprehensive

Test of Basic Skills) proved to be a more valid predictor of math success in the 9th grade (.54) than either scholastic aptitude tests or the California Short-form Test of Mental Maturity (Bush and Mattson, 1973).

The SCAT (School and College Ability Test) Series II has been used by some and found to be an effective tool for the highly precocious student (House, 1981). The SAT (Scholastic Aptitude Test) has been used as the most effective identifier for most talent searches like the SMPY (Trafton, 1981). These students being tested had already been identified as the top 2-3% on an age-grade test. The SAT had a high enough test ceiling to differentiate among their abilities (Keating, 1975; George, 1976). It chiefly measured reasoning ability, was available nationally, was a secure test, and had a scoring scale that remained constant from year to year (Stanley, 1980).

A definite correlation was found between the SAT-M and the mathematics known already (Bartkovich & Mezynski, 1981). The SAT was used because it worked and tapped even higher level of abilities (Keating, 1976). The SAT has discovered about 1300 12 and 13 year olds for SMPY per year (Stanley, 1980).

Creativity Tests

Efforts have been made to identify factors of creativity that correlate with mathematical talent. Using the constructs of Guilford's Structure-of-Intellect Model, Holly and Michael (1972)

studied factors of divergent and convergent production. They found the tests to be most valid toward the GPA and to need faster scoring techniques. Guilford (1975) and Meeker (1969) have tried to identify creative giftedness in an analytical manner. It has been felt that semantic divergent and productive thinking should be used to find special aptitudes in math (Holly & Michael). Torrance creativity tests of fluency, originality and flexibility have been used sometimes (Dirks & Quarfoth, 1981).

Studies showed that there was a low correlation between high IQ and high creative thinking ability (Guilford, 1975; Otey, 1978). All creative problem solvers had high IQ's (Guilford, 1975), but all those with high IQ's were not creative problem solvers. It was felt that creative thinking skills could be increased (Guilford, 1975). A study in gifted low and high achievers found that the low achievers tended to be weak in problem solving. The biggest differences on WISC subtests were in Arithmetic, Digit Span and Performance (Bush & Mattson, 1974). Proponents of creativity tests stated that intelligence tests, and the Stanford-Binet in particular, overemphasized cognition and memory (Guilford, 1975).

Mulit-dimensional criteria

Researchers agreed that intelligence tests alone were not adequate to identify talented students (Otey, 1978; Renzulli, 1977). Diverse criteria were needed. Systematic observation, pupil

products, and achievement and aptitude tests were used (Passow, 1979; Otey, 1978; Rubenzer, 1979).

Otey (1978) stated that at least three different criteria should be used. Tests that have previously been given should be used. A systematic search through the school's roster should provide nomination of all potential students. Teacher nominations, parent nominations and peer nominations were sometimes biased but helpful (Otey, 1978). Grades were often the best predictor of school success (Otey, 1978). Fifth and sixth grade marks together were a slightly better predictor than sixth grade alone (Sharp, 1975).

It is important to establish a pool of students from the screening methods mentioned. Students who qualify can then be given individual testing, if necessary; interviewed; or studied using a case study technique (Consuegra, 1981; Greenes, 1981). Special aptitude tests should be administered for special program selection. The Orleans-Hanna Algebra Prognosis Test is an effective tool for predicting readiness and success in first year Algebra (Buros, 1978). Caution should be taken to note that it is out-dated if the items have already been covered in previous math courses (Consuegra, 1981).

The case study method of identification has proven to be more effective than the traditional approach of using just group and individual testing. It was more accurate, more sensitive to

minority or disadvantaged and was not a hardship on time and cost (Renzulli & Smith, 1977).

Similarly, a study which compared identification by breadth versus depth found the latter to be more effective. The breadth model method used students with proven consistency who scored at least moderately well on several assessment areas. The depth model included anyone who scored in the top 2-3% on any one area. The depth model identified underachievers, higher IQ's and did not eliminate those with multiple talents (Dirks & Quarfoth, 1981).

Schools which did not assess student interest were liable to have higher attrition from accelerated mathematics classes (Sharp, 1975). The literature showed that students who were extremely able and eager were needed. It was important that participation was voluntary and that the students were self-motivated (George et al., 1980). Anastasi (In George et al.) stated that acceleration should not be like the spinach theory; specialization was for those who were interested.

Teacher identification

Studies have shown that teachers were not reliable for identifying all the potentially gifted students (Daurio, 1981; Otey, 1978; Dirks & Quarfoth, 1981). Teachers admired conformity, right answer, the work ethic, and the "do it my way--the right way" approach (Brodbelt, 1979). Research found that teachers didn't list courageousness of own convictions, independence of judgement,

or unwillingness to accept authorities' opinions as desirable student qualities (Gallagher, 1981 b). In both instances this was contrary to characteristics of the talented student.

Rubenzer (1979) reported that teachers were only 50% successful when asked to identify the gifted and talented students in their classes. The above mentioned Scale for Rating Behavioral Characteristics of Superior Students (Appendix B) was written to aid teachers.

A study which compared teacher identified students with SAT-M identified students concluded that tests were better identifiers than teachers. Students were chosen to enter a mathematics contest by both methods. Only three of the students were nominated by both methods. All of the SAT-M students scored in the top 25. The top teacher nominee scored fourth highest; the top three places went to SAT-M chosen. One teacher nominee scored only two correct points out of 140 (Stanley, 1976).

Thus one concludes from the literature that identifying mathematically talented math students should not be done with one single tool.

Summary

The literature illustrates that identification tools for the mathematically talented must measure learning traits, personality traits, intellectual ability, chances for success and particular mathematical strengths and weaknesses. A multiple-criteria

approach has been shown to be most effective for identifying all potentially talented mathematics students. The individual intelligence test is the best method to measure intellectual ability providing the ceiling is high enough. The individual test, however, is not often feasible in terms of time and money for a large group of students. There is the chance of missing students unless many are at least screened. For highly precocious (top 2-3%) the SAT has been found to be a better predictor for middle school age. Additional information from parents, peers, teachers and self-evaluations is helpful but not adequate on its own. If possible, case studies should be reviewed for all potential students.

Since the literature is not conclusive that there is one best method or tool for identifying mathematically talented students, no single prescription can be written to identify talented students in every school. It appears that a more scientific approach would be to research the effectiveness of the method being used in a certain school to see if: 1) all the mathematically talented students were being identified, and 2) only the mathematically talented students were the ones who were being programmed into the accelerated mathematics classes. Secondly, the correlation between the various identifying methods used and success and continuation in the program might validate the individual methods being used.

Chapter 3

METHODOLOGY

Statement of the Problem

The basic aim of this study was to develop information which would increase the accuracy with which success and continuance in accelerated mathematics could be predicted. Results of the study would aid school counselors, administrators and sixth grade teachers in selection of the best students to take 7th grade accelerated math.

Specifically, the accuracy of the selection process used at Piedmont Middle School was studied. Both a descriptive and a correlational study were undertaken to determine the continuance and success of two successive classes of identified students. In addition, students who accelerated on their own and unaccelerated "A" students in high math in high school were studied.

A variety of variables were available to be used as potential predictors of successful and continuing students in accelerated mathematics courses. The relationship between the selected prognostic factors and achievement was determined. Other available variables were correlated to success and continuance in the program.

Description of the Population

Piedmont, California, is a residential community of 10,498 citizens who live in 3,870 homes on 1.8 square miles. The city,

completely surrounded by Oakland, is located 10 miles east, across the bay from San Francisco. It is generally considered to be a community of affluence although there are many families of modest means. Population is predominantly Caucasian with the largest minority being of Oriental culture. In character it is urban and established. There are no major businesses or shopping areas and it is almost entirely composed of single family homes. The citizens are generally successful professionals or white collar people. They are usually family oriented and take advantage of the outstanding cultural opportunities, climate and environmental setting of the San Francisco Bay Area.

Piedmont prides itself on excellent schools. The citizens of the community completed a successful annual fund drive raising over $500,000 for the schools. This drive enabled the school district to maintain its current level of programs for 1983-84. There are 2,100 students in three elementary schools, a middle school and a high school. Piedmont Middle School consists of grades 6, 7, and 8. The 165 sixth graders are divided into six core classes of about 28 students each. Mathematics is taught by the core teacher who also teaches reading, social science, language and grammar. Students enter Piedmont High School, which is located adjacent to the middle school, in grade 9. The eighth grade algebra class is taught in the middle school but some students travel to the high school to take accelerated courses

in other subjects.

Piedmont Middle School students score very well on national achievement tests. The median scores of Piedmont students fall in the 80th percentile range on the Iowa Test of Basic Skills. This is compared to a national median at the 50th percentile.

Description of the Sample

The sample of the study consisted of three groups of students who were currently attending Piedmont High School. Group one consisted of 10th and 11th graders who had been identified at Piedmont Middle School in 1979 and 1978 respectively as students eligible to take accelerated math 7-8 in 7th grade. Group two were 10th and 11th grade students who had accelerated themselves in math by going to summer school or by taking two math courses in one year. Group three consisted of the unaccelerated 11th and 12th graders who were achieving an "A" in either advanced algebra or trigonometry/analytical geometry.

The correlational study used groups one and two. This sub-sample consisted of 39 males and 33 females. The mathematics grades of this group were very high. The range of mean mathematics grades from 7th grade to present was from 1.68 to 4.0 with the mean grade of 3.545, mode of 4.0 and median 3.715. (See Appendix C for a complete frequency list.) The 6th grade mathematics grades ranged from 2.0 to 4.0 with a mean of 3.716, mode of 4.0 and median of 3.816. (See Appendix D)

The Iowa Test of Basic Skills scores of this group were also very high. The Math Total scores ranged from 76 to 98 percentile rank with a mean of 93.68, mode of 97 and a median of 95.38. (See Appendix E) The Total Test results from the Iowa Test ranged from 67 to 99 with a mean of 92.31, mode of 99 and median of 94.20. (See Appendix F)

Permission to Conduct the Study

Permission to conduct the study was granted by Robert L. French, Ed.D., Superintendent of the Piedmont Unified School District.

Questions Studied

The studies attempted to answer the questions: How effective was the identification process for selection into accelerated math 7-8? Which selection criteria best predicted success and continuance in the accelerated math program?

Specifically, answers to the following questions were sought:

1. What percentage of the identified students remained in the program?

2. What percentage of the identified students were successful in the program?

3. What percentage of all accelerated students who attended Piedmont Middle School were identified?

4. What percentage of all accelerated students had accelerated on their own?

5. Which selection criteria most accurately predicted success and continuance in the accelerated mathematics program?

Definition of Terms

Accelerated math: the same subject content taken one or more years earlier than the conventional curriculum. For example, eighth graders taking algebra, ninth graders taking geometry.

Success: a grade of "A" or "B" in geometry, advanced algebra, and trigonometry/analytical geometry. The mean grade of these subjects was computed and labeled "success".

Continuance: students who continued to take math and did so one or more years earlier than the conventional curriculum.

Age: chronological age in months in May of 6th grade year.

Math Total Score of Iowa Test of Basic Skills: score of the two mathematics subtests on concepts and problem solving in the national achievement test administered to all Piedmont Middle School Students.

Test Total Score of Iowa Test of Basic Skills: total composite score of eleven subtests which cover skills development in vocabulary, reading comprehension, spelling, capitalization, punctuation, usage, map reading, reading graphs and tables, knowledge and use of reference materials, mathematics concepts and mathematics problem solving.

Source and Collection of the Data

Grade books from Piedmont Middle School of the 1978-79 and 1979-80 mathematics classes provided a list of students who had been identified and had accepted acceleration.

Piedmont High School provided class rosters of the 1982-83 advanced algebra and trigonometry/analytical geometry classes. These rosters were used to identify accelerated students as well as all students enrolled in the classes.

Student transcripts and cumulative folders were used to obtain sixth grade math grades, math 7-8 grades, algebra grades, geometry grades, advanced algebra grades, trigonometry/analytical geometry grades, calculus grades, present course level, Iowa Test of Basic Skills math total scores and test total scores, age, gender, summer school classes attended, and years of taking two math courses simultaneously.

Analytical Procedures

A table was constructed for groups one and two recording all 21 variables opposite each of the 72 students' code numbers. (see Appendix G) Frequency tables were run on the computer using the Statistical Package for the Social Sciences program. The numbers in group three were counted. A descriptive study answered the following questions:

1. What percentage of the students who were identified as accelerated students were successful in high school mathematics?

2. What percentage of the students who were identified as accelerated students were continuing in accelerated mathematics?

3. Were there unidentified unaccelerated students who were presently receiving "A's" in advanced algebra or trigonometry/ analytical geometry?

4. Were there students who had attended Piedmont Middle School since 7th grade who were unidentified and had successfully accelerated later in mathematics?

A correlational study was undertaken using groups one and two as the sample. An intercorrelational matrix for all variables was obtained. Multiple regression equations were developed to further test for the best predictors and combinations of predictors for success and continuance in the accelerated program. Computer SPSS programs were used in each case.

The following hypotheses were tested:

1. There is a significant relationship between success in high school math and sixth grade math grade.

H_0 -There is no significant relationship between success in high school math and sixth grade math grade.

2. There is a significant relationship between success in high school math and Iowa math total score.

H_0 -There is no significant relationship between success in high school math and Iowa math total score.

3. There is a significant relationship between success in

high school math and Iowa test total score.

H_0 -There is no significant relationship between success in high school math and Iowa test total score.

4. There is a significant relationship between success in high school math and age.

H_0 -There is no significant relationship between success in high school math and age.

5. There is a significant relationship between success in high school math and gender.

H_0 -There is no significant relationship between success in high school math and gender.

6. There is a significant relationship between success in high school math and the combination of Iowa math total score and sixth grade math grade.

H_0 -There is no significant relationship between success in high school math and the combination of Iowa math total score and sixth grade math grade.

7. There is a significant relationship between success in high school math and the combination of sixth grade math grade, Iowa math total score and Iowa test total score.

H_0 -There is no significant relationship between success in high school math and the combination of sixth grade math grade, Iowa math total score and Iowa test total score.

8. There is a significant relationship between success in

high school math and the combination of age, Iowa math total score, and Iowa test total score.

H_0 -There is no significant relationship between success in high school math and the combination of age, Iowa math total score, and Iowa test total score.

9. There is a significant relationship between success in high school math and the combination of grade in math 7-8 and Iowa math total score.

H_0 -There is no significant relationship between success in high school math and the combination of grade in math 7-8 and Iowa math total score.

10. There is a significant relationship between success in high school math and the combination of age, Iowa math total score, Iowa test total score, and sixth grade math grade.

H_0 -There is no significant relationship between success in high school math and the combination of age, Iowa math total score, Iowa test total score, and sixth grade math grade.

11. There is a significant relationship between success in high school math and the combination of Iowa math total score, Iowa test total score, sixth grade math grade and grade in math 7-8.

H_0 -There is no significant relationship between success in high school math and the combination of Iowa math total score, Iowa test total score, sixth grade math grade and grade in math 7-8.

12. There is a significant relationship between success in high school math and the combination of age, Iowa math total score, Iowa test total score, sixth grade math grade, and grade in math 7-8.

H_0 -There is no significant relationship between success in high school math and the combination of age, Iowa math total score, Iowa test total score, sixth grade math grade, and grade in math 7-8.

13. There is a significant relationship between continuance in the program and Iowa math total score and Iowa test total score.

H_0 -There is no significant relationship between continuance in the program and Iowa math total score and Iowa test total score.

14. There is a significant relationship between continuance in the program and sixth grade math grade and Iowa math total score.

H_0 -There is no significant relationship between continuance in the program and sixth grade math grade and Iowa math total score.

15. There is a significant relationship between continuance in the program and sixth grade math grade, Iowa math total score, and Iowa test total score.

H_0 -There is no significant relationship between continuance in the program and sixth grade math grade, Iowa math total score, and Iowa test total score.

16. There is a significant relationship between continuance in the program and age, sixth grade math grade, and Iowa math total score.

H_0 -There is no significant relationship between continuance in the program and age, sixth grade math grade, and Iowa math total score.

17. There is a significant relationship between continuance in the program and grade in math 7-8, sixth grade math grade, Iowa math total score, Iowa test total score and age.

H_0 -There is no significant relationship between continuance in the program and grade in math 7-8, sixth grade math grade, Iowa math total score, Iowa test total score and age.

Results of the multiple regression equations were analyzed and interpreted. A summary and conclusions were formed and reported.

Chapter 4

RESULTS

Descriptive Study

The total number of identified talented mathematics students who accelerated in math 7-8 for the two years studied was 53. Table I lists data on these students. Of the 53 identified students, 51 or 96% were successful in high school math. The total number continuing in the accelerated program was 44 or 83%. Table II lists those who dropped, who number nine, or 17%. The 44 identified and continuing were all successful in high school mathematics (100%). Seven of the nine who dropped the accelerated program but continued taking mathematics at the normal rate were successful in their high school mathematics. Only two students (4%) from the 53 originally identified group were not successful. Identified students included 31 females (58.5%) and 22 males (41.5%).

Unaccelerated students receiving an "A" in advanced algebra numbered 14. Two of these had been identified in 1978-79 but chose not to accelerate because of the 7 a.m. class time. There were eight unaccelerated twelfth graders who received an "A" in trigonometry/analytical geometry. These 22 students represented 33-1/3% of the "A's" in those two subjects.

The total number of students who accelerated on their own and had not been identified was 18. This represented 19.5% of all the accelerated students in grades 10 and 11. Fifteen males and

two females accelerated one year; one male accelerated two years. Table III lists these students. The one remaining student in the sample of 72 had not been identified in 6th grade but was allowed to try 8th grade algebra and dropped out.

Correlational Study

Pearson correlation coefficients were found among all the possible predictor variables. These are presented in Table V. Table VI illustrates that the variables available to sixth grade teachers showed a low but positive correlation to success in high school mathematics. Sixth grade math grade correlated at .291, Iowa math total score at .305, Iowa test total score at .246 and age at .128. The highest meaningful correlations to success were grade in math 7-8 (.589) and algebra grade (.722). The high correlations between success and the individual grades in geometry, advanced algebra, trigonometry/analytical geometry were meaningless because the success score contained the mean of these grades.

Continuance correlated poorly with the variables available to sixth grade teachers. Sixth grade math grade correlated at .138, Iowa math total score at .132, Iowa test total score at .129 and age at .131. Again the highest correlations were the grade in math 7-8 (.554) and algebra (.516).

Significant relationships were found between success and sixth grade math, Iowa math total score and Iowa test total score.

Null hypotheses 1, 2, and 3 were rejected and the hypotheses 1, 2, and 3 accepted. That is there is a significant relationship between success in high school math and sixth grade math grade ($p < .01$); Iowa math total score ($p < .01$); Iowa test total score ($p < .03$). It was not possible to reject null hypotheses 4 and 5. Significant relationships were not found between success and age or gender.

TABLE I

GROUP ONE: IDENTIFIED STUDENTS

Code	Gender	Age	Grade	Still Accelerated	6th Grade Math Grade	Iowa Math Total	Iowa Test Total	Success
1	M	150	11	yes	3	95	90	3.80
2	F	137	11	yes	4	93	92	3.60
3	F	143	11	yes	4	98	98	4.00
4	F	135	11	yes	3	91	82	3.57
5	M	142	11	yes	4	97	93	3.80
6	F	138	11	yes	4	96	96	3.80
7	F	139	11	yes	4	94	92	4.00
8	M	140	11	yes	4	99	97	4.00
9	F	126	11	yes	4	--	--	3.60
10	F	147	11	yes	4	85	88	4.00
11	F	148	11	no	2	91	89	3.00
13	M	146	11	yes	4	94	--	3.80
14	F	143	10	no	4	94	97	4.00
16	M	141	11	no	3	98	97	3.67
17	F	145	11	yes	4	99	99	3.20
18	M	150	11	yes	4	88	93	3.20
19	F	142	11	yes	4	99	97	3.33
20	M	142	11	yes	-	--	--	3.71
21	F	142	11	yes	4	95	93	4.00
22	F	146	11	yes	4	97	94	4.00
23	M	143	11	yes	4	97	98	3.80
24	M	147	11	yes	4	99	99	4.00
25	M	140	10	no	4	93	67	3.00
26	F	144	11	yes	4	95	95	4.00
27	F	146	11	yes	4	99	99	4.00
29	M	149	11	yes	4	94	94	4.00
30	M	143	10	no	4	--	--	2.00
31	F	140	10	yes	4	95	96	4.00
32	M	145	10	yes	3	--	--	3.00
33	F	138	10	yes	4	95	94	3.33
34	F	147	10	yes	4	91	89	3.67
35	M	146	10	yes	4	96	93	3.80
36	M	148	10	yes	-	--	--	4.00
37	F	133	10	yes	4	98	99	3.67
39	F	141	10	yes	-	--	--	4.00
40	M	149	10	yes	3	99	97	4.00
41	F	144	10	yes	4	86	90	4.00
43	F	146	10	yes	4	97	99	2.47
44	F	140	10	yes	4	97	98	4.00

TABLE I continued

Code	Gender	Age	Grade	Still Accelerated	6th Grade Math Grade	Iowa Math Total	Iowa Test Total	Success
46	M	148	10	yes	3	97	98	2.60
47	F	143	10	yes	4	98	98	3.33
48	M	143	10	yes	4	98	97	4.00
50	F	147	10	yes	4	99	99	4.00
52	F	137	10	yes	4	98	95	4.00
53	F	126	10	yes	3	95	90	3.33
54	F	140	10	no	4	--	--	3.00
56	M	141	10	no	4	93	96	3.00
57	M	144	10	yes	3	97	96	3.67
58	M	147	10	yes	4	97	83	4.00
62	M	148	10	yes	4	99	99	4.00
64	F	140	10	yes	4	94	94	3.67
83	F	142	10	no	3	98	95	3.00
84	F	145	10	no	4	90	81	2.00

TABLE II

IDENTIFIED STUDENTS WHO DROPPED

Code	Sex	Age	Grade	6th Grade Math	Iowa Math	Iowa Total	Success	How Dropped
11	F	148	11	2.0	91	89	3.06	Repeated Algebra
14	F	143	10	4.0	94	97	4.00	Chose not to take Algebra
16	M	141	11	4.0	98	97	3.34	Repeated Algebra
25	M	140	10	4.0	93	67	3.00	Drop 7-8
30	M	143	10	---	--	--	2.00	Drop 7-8
54	F	140	10	4.0	--	--	3.00	Repeated Algebra
56	M	141	10	4.0	93	96	3.00	Repeated Algebra
83	F	142	10	3.0	98	95	3.00	Drop 7-8
84	F	145	10	4.0	90	81	2.00	Drop 7-8

TABLE III

GROUP TWO: NOT IDENTIFIED BUT ACCELERATED ON OWN

Code	How Accelerated	Age	Grade	Sex	Success	Math	Sem	Math/Sem
42	2/1	146	10	M	4.00	9	7	1.3
55	2/1 & SS	143	10	M	4.00	11	7	1.5
63	2/1	146	10	M	4.00	9	7	1.3
66	SS	144	10	M	4.00	9	7	1.3
67	2/1	140	10	M	3.00	9	7	1.3
68	2/1	142	10	F	3.00	9	7	1.3
70	SS	142	10	M	3.67	9	7	1.3
71	SS	146	10	M	3.67	9	7	1.3
72	SS	146	10	M	3.33	9	7	1.3
73	2/1	144	10	M	4.00	9	7	1.3
74	SS	147	10	M	3.33	9	7	1.3
81	SS	138	11	M	3.00	11	9	1.2
82	2/1	146	11	M	3.80	11	9	1.2
85	SS	137	11	M	2.20	10	9	1.1
86	SS	151	11	M	3.60	11	9	1.2
88	SS	146	11	M	3.80	11	9	1.2
89	2/1	136	11	M	3.40	11	9	1.2
90	2/1	139	11	M	3.60	11	9	1.2

TABLE IV

MEANS AND STANDARD DEVIATIONS FOR VARIABLES IN HYPOTHESES 1-17*

VARIABLE	MEAN	STANDARD DEV	CASES
Success	3.6086	.4825	59
6th Grade	3.6780	.5065	59
Iowa Math Total	93.4915	5.8173	59
Iowa Test Total	92.3051	7.1589	59
Age	142.8983	4.8055	59
Grade 7-8	3.5864	.6112	59
ACCSS	.1864	.3928	59
Continuance	.8475	.3625	59
ACC2INI	.1695	.3784	59

*Computer program picked up only 59 cases for this computation because the other 13 cases had information missing. The researcher identified each missing case and found them to be proportionately divided between identified and not identified. Missing cases do not weaken the results.

TABLE V

INTERCORRELATIONS OF VARIABLES IN HYPOTHESES 1-17

	Success	6th Grade	Iowa Math Total	Iowa Test Total	Age	Grade 7-8	Summer School	Continuance
6th Grade	.37							
Iowa Math Total	.32	.35						
Iowa Test Total	.25	.25	.67					
Age	.10	-.01	.02	.09				
Grade 7-8	.58	.11	.21	.27	.11			
Summer School	-.15	-.21	-.35	-.06	.23	-.08		
Continuance	.52	.20	.13	.12	.16	.55	.08	
ACC2INI	-.01	-.16	-.13	-.22	-.09	.16	-.10	.19

TABLE VI

CORRELATIONS BETWEEN SUCCESS AND POTENTIAL PREDICTOR VARIABLES

Variables	r	n	p	Variables	r	n	p
Age	.13	72	.143	Grade 7-8	.59	71	.001
Sex	-.04	72	.371	Algebra	.72	72	.001
Trig/Ana	.89	33	.001	Geometry	.88	72	.001
Calculus	.75	3	.230	Adv Algebra	.82	65	.001
Mean Grade	.88	72	.001	Continuance	.55	72	.001
Year School	.13	72	.139	Acc 2 in 1	.02	72	.440
Summer School	.11	72	.174	Course	.34	72	.002
Sixth Grade	.29	66	.009	Math Total	.30	61	.009
Sem of Math	.36	72	.001	Nat Total	.25	60	.029
Identified	.07	72	.277	Sem of Math	.36	72	.001
Actual Sem	.13	72	.139	Math Per Sem	.42	72	.001

TABLE VII

CORRELATIONS BETWEEN CONTINUANCE AND POTENTIAL PREDICTOR VARIABLES

Variables	r	n	p	Variables	r	n	p
Age	.13	72	.136	Grade 7-8	.55	71	.001
Sex	.003	72	.489	Algebra	.52	72	.001
Trig/Ana	.62	33	.001	Geometry	.49	72	.001
Calculus	.99	3	***	Adv Algebra	.24	65	.029
Mean Grade	.65	72	.001				
Year School	.07	72	.282	Acc 2 in 1	.29	72	.047
Summer School	.10	72	.204	Course	.56	72	.001
Sixth Grade	.14	66	.135	Math Total	.13	61	.155
Sem of Math	.58	72	.001	Nat Total	.13	60	.164
Identified	.08	72	.255	Actual Sem	.58	72	.001
Math per Sem	.73	72	.001	Success	.55	72	.001

Multiple regression equations were used to test the remainder of the null hypotheses. Using the independent variables in combinations of two, three, four and five, regressions were solved with the dependent variables of success and continuance. The goal was to find the combination of variables that would best predict success and continuance in the accelerated mathematics program.

It was possible to reject six of the remaining seven null hypotheses relating success to the independent variables. Tables X, XI, and XII show that null hypotheses 6, 7, 9, 10, 11, and 12 could be rejected. Success could be predicted using the following combinations in the ranked order of:

1. Math 7-8 grade, Iowa math total score, 6th grade math grade, age, and Iowa test total score. $r = .66455$ $p = .000$

2. Math 7-8 grade, Iowa math total score, sixth grade math grade, Iowa test total score. $r = .66248$ $p = .000$

3. Math 7-8 grade, Iowa math total score. $r = .61052$ $p = .000$

4. Iowa math total score, 6th grade math grade, age, and Iowa test total score. $r = .43531$ $p < .03$

5. Iowa math total score, 6th grade math grade, Iowa test total score. $r = .42425$ $p < .02$

6. Iowa math total score, 6th grade math grade. $r = .42108$ $p < .005$

Null hypotheses 8 could not be rejected. The combination of age, Iowa math total score and Iowa test total score did not

significantly predict success.

It is noted in the regression summary tables, VIII, IX and X that the independent variables were entered into the equation by the computer in the following ranked order of significance: (1) math 7-8 grade, (2) sixth grade math grade, (3) Iowa math total score, (4) age, and (5) Iowa test total score. In combinations with age and Iowa test total score as independent variables the multiple r increased but the significance decreased.

Null hypotheses 13, 14, 15, and 16 could not be rejected. Null hypotheses 17 could be rejected omitting the variable Iowa math total score. A multiple r of .57976 with p = .000 was reached using math 7-8 grade, 6th grade math grade, age and Iowa test total score. The computer withheld the 5th independent variable of Iowa math total score. See Tables XI and XII. Table XIII presents an abbreviated summary of all regression equation results.

Further Results

Further study of the nine identified students who were not continuing in the accelerated program produced the following results. There were five females and four males who ranged in chronological age from 140 months to 148 months. The range of the entire sample was from 126 to 151 months. Two of the dropped students had 2.0 averages in high school mathematics and thus were not successful. The only other dropped student above a 3.5

TABLE VIII

REGRESSION SUMMARY TABLE

HYPOTHESIS 6: SUCCESS WITH SIXTH GRADE MATH GRADE AND IOWA TEST MATH TOTAL SCORE

DEPENDENT VARIABLE.. SUCCESS

STEP	VARIABLE	F RATIO	SIGNIFICANCE	MULTIPLE R	R SQUARE	SIMPLE P	OVERALL F	SIGNIFICANCE
1	Sixth Gr	9.11681	.004	.37133	.13789	.37133	9.11681	.004
2	Math Tot	2.68352	.107	.42108	.17731	.31687	6.03480	.004

HYPOTHESIS 7: SUCCESS WITH IOWA TEST MATH TOTAL SCORE, SIXTH GRADE MATH GRADE, AND IOWA TEST TOTAL SCORE

DEPENDENT VARIABLE... SUCCESS

1	Sixth Gr	9.11681	.004	.37133	.13789	.37133	9.11681	.004
2	Math Tot	2.68352	.107	.42108	.17731	.31687	6.03480	.004
3	Nat Tot	.17944	.674	.42425	.17999	.25357	4.02406	.012

HYPOTHESIS 8: SUCCESS WITH IOWA TEST MATH TOTAL SCORE, AGE AND IOWA TEST TOTAL SCORE

DEPENDENT VARIABLE... SUCCESS

1	Math Tot	6.36189	.014	.31687	.10041	.31587	6.36189	.014
2	Age	.60151	.441	.33161	.10997	.10478	3.45946	.038
3	Nat Tot	.13323	.717	.33484	.11212	.25357	2.31502	.086

TABLE IX

REGRESSION SUMMARY TABLE

HYPOTHESIS 9: SUCCESS WITH MATH 7-8 GRADE AND IOWA TEST MATH TOTAL SCORE

DEPENDENT VARIABLE.. SUCCESS

STEP	VARIABLE	F RATIO	SIGNIFICANCE	MULTIPLE R	R SQUARE	SIMPLE R	OVERALL F	SIGNIFICANCE
1	Grade 7-8	28.32118	.000	.57614	.33194	.57614	28.32118	.000
2	Math Tot	3.64184	.061	.61052	.37273	.31687	16.63782	.000

HYPOTHESIS 10: SUCCESS WITH IOWA TEST MATH TOTAL SCORE, SIXTH GRADE MATH GRADE, AGE, IOWA TEST TOTAL SCORE

1	Sixth Gr	9.11681	.004	.37133	.13789	.37133	9.11681	.004
2	Math Tot	2.68352	.107	.42108	.17731	.31687	6.03480	.004
3	Age	.70538	.405	.43328	.18773	.10478	4.23716	.009
4	Nat Tot	.11769	.733	.43531	.18950	.25357	3.15631	.021

HYPOTHESIS 11: SUCCESS WITH MATH 7-8, IOWA TEST MATH TOTAL SCORE, SIXTH GRADE MATH GRADE, IOWA TEST TOTAL SCORE

1	Grade 7-8	28.32118	.000	.57614	.33194	.57614	28.32118	.000
2	Sixth Gr	9.25427	.004	.65321	.42668	.37133	20.88834	.000
3	Math Tot	1.05279	.309	.66140	.43745	.31687	14.25625	0
4	Nat Tot	.13790	.712	.66248	.43888	.25357	10.55907	.000

TABLE X

REGRESSION SUMMARY TABLE

HYPOTHESIS 12: SUCCESS WITH MATH 7-8 GRADE, IOWA TEST MATH TOTAL, SCORE, SIXTH GRADE MATH GRADE, AGE, IOWA TEST TOTAL SCORE

DEPENDENT VARIABLE.. SUCCESS

STEP	VARIABLE	F RATIO	SIGNIFICANCE	MULTIPLE R	R SQUARE	SIMPLE R	OVERALL F	SIGNIFICANCE
1	Grade 7-8	28.32118	.000	.57614	.33194	.57614	28.32118	.000
2	Sixth Gr	9.25427	.004	.65321	.42668	.37133	20.83834	.000
3	Math Tot	1.05279	.309	.66140	.43745	.31687	14.25625	.000
4	Age	.23305	.631	.66322	.43987	.10478	10.60135	.000
5	Nat Tot	.16698	.684	.66455	.44162	.25357	8.38365	.000
	HYPOTHESIS 13: CONTINUANCE WITH IOWA TEST MATH TOTAL SCORE AND IOWA TOTAL TEST SCORE							
1	Math Tot	.92042	.341	.12606	.01589	.12606	.92042	.341
2	Nat Tot	.16606	.685	.13712	.01880	.12450	.53651	.588
	HYPOTHESIS 14: CONTINUANCE WITH SIXTH GRADE MATH GRADE AND IOWA TEST MATH TOTAL SCORE							
1	Sixth Gr	2.30808	.134	.19727	.03892	.19727	2.30808	.134
2	Math Tot	.21263	.647	.20628	.04255	.12606	1.24441	.296

TABLE XI

REGRESSION SUMMARY TABLE

HYPOTHESIS 15: CONTINUATION WITH SIXTH GRADE MATH GRADE, IOWA TEST TOTAL SCORE, IOWA TEST MATH TOTAL SCORE

DEPENDENT VARIABLE.. STILLACC

STEP	VARIABLE	F RATIO	SIGNIFICANCE	MULTIPLE R	R SQUARE	SIMPLE R	OVERALL F	SIGNIFICANCE
1	Sixth Gr	2.30808	.134	.19727	.03892	.19727	2.03808	.134
2	Nat Tot	.35977	.551	.21225	.04505	.12450	1.32096	.275

HYPOTHESIS 16: CONTINUATION WITH SIXTH GRADE MATH GRADE, AGE, AND IOWA TEST MATH TOTAL SCORE

1	Sixth Gr	2.30808	.134	.19727	.03892	.19727	2.30808	.134
2	Age	1.54127	.220	.25428	.06466	.15914	1.93563	.154
3	Math Tot	.18576	.668	.26040	.06781	.12606	1.33358	.273

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TABLE XII

REGRESSION SUMMARY TABLE

HYPOTHESIS 17: CONTINUATION WITH MATH 7-8 GRADE, SIXTH GRADE MATH GRADE, AGE, IOWA TEST TOTAL SCORE AND IOWA TEST TOTAL TOTAL SCORE

DEPENDENT VARIABLE.. STILLACC

STEP	VARIABLE	F RATIO	SIGNIFICANCE	MULTIPLE R	R SQUARE	SIMPLE R	OVERALL F	SIGNIFICANCE
1	Grade 7-8	24.79313	.000	.55056	.30312	.55056	24.79313	.000
2	Sixth Gr	1.51611	.223	.56700	.32149	.19727	13.26687	.000
3	Age	.89187	.349	.57647	.33232	.15914	9.12479	.000
4	Nat Tot	.30983	.580	.57976	.33613	.12450	6.83517	.000

TABLE XIII

SUMMARY TABLE OF MULTIPLE REGRESSION EQUATION RESULTS

Success with Predictor Variables	Multiple r	Overall F	Significance
6. Math total, 6th grade	.42108	6.03480	.004*
7. Math total, 6th grade, test total	.42425	4.02406	.012
8. Math total, age, test total	.33484	2.31502	.086
9. Math 7-8, math total	.61052	16.63782	.000*
10. Math total, 6th grade, age, test total	.43531	3.15631	.021
11. Math 7-8, math total, 6th grade, test total	.66248	10.55907	.000*
12. Math 7-8, math total, 6th grade, age, test total	.66455	8.38365	.000*
Continuance with			
13. Math total, test total	.13712	.53651	.588
14. 6th grade, math total	.20628	1.24441	.296
15. 6th grade, test total, (Math total)*	.21225	1.32096	.275
16. 6th grade, math total, age	.26040	1.33358	.273
17. Math 7-8, 6th grade, (math total)*, age, test total	.57976	6.83517	.000*

*($p \leq .05$ significant at or beyond the .05 level)

average in high school mathematics was a 4.0 student who chose not to take 8th grade algebra because of lack of interest and fear of not being successful.

It was also found that the 78-79 class had two drop outs of 26 or 8% while 21% or 7 out of 34 dropped out of the 1979-80 class. It was discovered by the researcher that the 78-79 class was actually chosen the 2nd quarter of the 7th grade and asked to come before school during an "0" period for mathematics. This eliminated any students who were not willing to get up early. The drop ratio represents a 62% increase between the class that was identified in 7th grade and the one identified in 6th grade. The two 78-79 drops were after algebra. Two of the 79-80 drops were after algebra; five drops were during 7th grade.

The group who accelerated on their own contained 17 males and one female. Seven were from the 78-79 class and 11 were from the 79-80 class. The chronological ages ranged from 136 to 151 months with no significant pattern. Nine took summer school courses; eight took two math classes in one year; one boy took both summer school and two classes in one year and accelerated two years. One student in this group was not successful in high school mathematics with a 2.20 average. Five students had a 4.0 ("A") average; six ranged from a 3.0 to 3.5 average; six had a 3.60 to 3.80 average.

The study also found that seven of the identified accelerated

students (four males and three females) had accelerated further on their own.

Interpretations

Both the descriptive and correlational studies showed that age had a low correlation with both success and continuance in the accelerated program. It had a higher correlation with continuance than with success. There were similar ranges of ages in all groups. The ages of the group that dropped out were slightly older than the continuing students. The opposite might have been expected. The older ages cannot be explained by grade because there were more 10th graders than 11th who discontinued.

Although there is no significant relationship between success or continuance and gender, there is a significant difference in the group who accelerated on their own. The males comprised 88% of this group. Several explanations are possible. Middle school age males mature slower than females. Creative verbal middle school age males often are not as appreciated by teachers and thus are not recommended for acceleration. Males in high school see the need for mathematics in their future careers and thus accelerate on their own. Lastly, the stereotypes of females and mathematics still exist. Females, consequently, lack enough confidence and encouragement to accelerate themselves in mathematics.

The differences in the predictability between 6th grade math grade and math 7-8 grade are surprising. Sixth grade math grades

are given by six different core teachers who are not trained as mathematics teachers. The math 7-8 grades were given by one trained mathematics teacher who had the advantage of comparing all the accelerated students in one classroom. This may account for the higher reliability of the math 7-8 grade.

The few drops in the 78-79 class can be partially explained by two main factors. First, the trained mathematics teachers of mathematics 7 recommended the students who were 6 months older than the students who were recommended in 6th grade. Secondly, the 78-79 students had to be sufficiently interested and motivated to attend mathematics class every day at 7 a.m. This may have eliminated potential drop students.

Chapter 5

SUMMARY, CONCLUSIONS, LIMITATIONS, AND RECOMMENDATIONS

Summary

This study was undertaken to determine if success and continuance in an accel..ated high school mathematics program could be predicted and which identifying tools would best accomplish this purpose. Relevant professional literature stated that it was desirable for some students to be taught mathematics at a rate faster than the normal curriculum. It stated that many talented youngsters were not being identified. Several studies also concluded that the more identifying tools that could be used the better. This researcher hoped to find the best identifying tools for talented mathematics students.

Using a sample group of 72 10th and 11th grade students, attending Piedmont High School, who were either identified for accelerated or had accelerated on their own, a descriptive and correlational study found the relationships between success and continuance in high school mathematics and the possible identifying variables.

A total of 21 variables were obtained for each student including: age; gender; 6th grade math grades; math 7-8 grades; 8th grade math or algebra grades; geometry; advanced algebra and trigonometry/analytical geometry grades; calculus grades; mean score of math grades from 7th grade to present; math courses in

summer school; years of taking two math courses in one year; identified or not for math 7-8; present year in school; present math course; Iowa math total score and test total score; still accelerated or not; semesters of math taken beginning with 7th grade; semesters of school attended beginning with 7th grade; semesters of math completed per semester of school.

It was found that 83% of the identified students remained in the accelerated program. Of the identified students 96% were successful in high school mathematics. Of all the now accelerated students who attended Piedmont Middle School in 6th and/or 7th grades 70.5% were identified. The remaining 29.5% of all the accelerated students in 10th and 11th grades had accelerated on their own by taking a math course in summer school or by taking two mathematics courses in one year.

The correlational study found that the variables of math 7-8 grades and algebra grades had the highest correlation with both success and continuance in the program. Since these cannot be used in the 6th grade as identifying tools, combinations of variables with lower correlations needed to be found as an identifying tool.

Multiple regression equations found the best predictors for success to be those combinations containing math 7-8 grades. The next best predictor for success was the combination of Iowa math total score, 6th grade math grade, age and Iowa test total score.

Combinations of Iowa math total score, 6th grade math grade and Iowa test total score (R = .435) and Iowa math total score and 6th grade math grade (R = .421) predicted success but with less significance.

It was found that continuance was harder to predict. Unless the math 7-8 grade was put into the regression equation the highest multiple R found was with the independent variables 6th grade math grade, Iowa math total score and age (R = .260) with no significance.

It was also found that the class that was identified in December of 7th grade had fewer dropouts than the class identified in the 6th grade. This class also had to commit to come before school at 7 a.m. to take the accelerated mathematics class.

The only significant difference between male and female students was in the group who accelerated themselves. This group consisted of 88% males.

Unaccelerated students receiving an "A" in advanced algebra and trigonometry/analytical geometry numbered 22. These students represented 1/3 of the "A's" in those subjects.

Conclusions

It was concluded by this researcher that consideration should be given to using the math 7-8 grade as an identifying criterion of talented students. This would be accomplished if two classes

of accelerated math 7-8 students were identified in 6th grade. This group could be taught a 7th grade honors class that would prepare the students for algebra. The students who were ready could be taught algebra in eighth grade; the remaining students could be taught an enriched 8th grade mathematics honors course. This might pick up some of the 33-1/3% students who are presently accelerating later, eliminate the 29.5% who drop out, and give twice as many students a stronger mathematics base and chance to accelerate. The fact that there were 55% fewer dropouts from the 77-78 class than the 79-80 class when the students were identified in 7th grade supports the thesis that the later students are identified the better. This suggested program utilizes the findings of the study that the best predictor of both success and continuance in the program is the math 7-8 grade.

It is also suggested that student interest in and motivation toward mathematics be measured prior to identification in 6th grade. In a related study this researcher was able to obtain significantly high "t" values on a non-standardized scale of math interest ($t = 4.555$ to 8.948)* indicating it is possible to reliably test for interest in mathematics. This scale (see Appendix H) could be administered to all sixth graders as an additional identifying tool. This scale would be in addition to the mathematics problem-solving test which was initiated at Piedmont Middle School after 1980 as an identifying tool.

Further, it was concluded that age might be considered in

* $t \geq 1.75$ is significant

borderline cases, realizing that the correlation is low and has limited significance.

Limitations

The composition and size of the sample were the major limitations of this study. Not only were the students taken from the top portion of the grading scale, but the school population of Piedmont is also more homogeneous toward the upper end of the scale than the population of other schools.

When correlating with success in a sample that was 96% successful, results were less defineable and reliable.

The students were not randomly assigned to the sample but chosen from complete classes.

As in most correlational research, the ability to generalize beyond the research locale is limited. The subjectivity of grades was also a limitation.

Recommendations

With the above limitations in mind, five general recommendations are made, as a result of this study.

First, another study is recommended using two entire grades and incorporating two new variables: the problem solving test that is now being given to all sixth graders the mathematics interest scale in Appendix H.

Second, special attention should be paid to male students who may have mathematics aptitude and need the challenge of

accelerated classes.

Third, special attention should be paid to all students in 7th grade mathematics to see which might be eligible to move into accelerated mathematics during 7th or at the beginning of 8th grade.

Fourth, consideration should be given to identifying two classes of students for accelerated math 7-8 (or math 7 honors), dividing the class into two sections for 8th grade. One section would be taught algebra and the other an enriched 8th grade honors mathematics course. This recommendation is based on the findings that the math 7-8 grade is the best predictor other than the algebra grade of success and continuance in the accelerated mathematics program. The advantages of this program would be: more accurate identification of talented mathematics students, the chance to accelerate for twice as many students, and the offering of a stronger mathematics curriculum for more students.

Fifth, selection of accelerated students should be made on an individual case study method. The more variables of input the more complete the picture. Students and parents should be given the option to accept acceleration or not. The mathematics interest scale or another similar tool should be used to assess student interest and motivation. Methods of accelerating in high school mathematics should also be explained to students and parents.

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APPENDIX A

Characteristics of gifted mathematics students: (Keating)

1. Propensity toward quantitative relationships and use of numbers.
2. Apply mathematics principles to other situations.
3. Extraordinary memory for mathematical concepts and principles.
4. Ability in advanced conceptualization of mathematical principles.
5. Capable of abstract thinking.
6. Exhibits the formal operations of hypothetical-deductive reasoning.
7. Exhibits the formal operations of proportional reasoning.
8. Exhibits the formal operations of separation and control of variables at an early age.
9. Insight into problem solutions.
10. Resourcefulness in solving arithmetic problems.
11. Solution through intuition (at times).

Appendix A (continued)

Rating scale: (Consuegra)

1. Uses numbers skillfully.
2. Understands math concepts well.
3. Applies math concepts.
4. Uses insight to solve problems.
5. Interrelates mathematical concepts.
6. Thinks abstractly.
7. Enjoys numbers.
8. Forms hypotheses.
9. Understands proportions.
10. Conducts experiments carefully.

Appendix B

Joseph S. Renzulli
Robert K. Hartman

SCALE FOR RATING BEHAVIORAL CHARACTERISTICS OF SUPERIOR STUDENTS

Name_____ Date_____

School_____ Grade_____ Age_____
years months

Teacher or person completing this form_____

How long have you known this child?_____Months.

Directions. These scales are designed to obtain teacher estimates of a student's characteristics in the areas of learning, motivation, creativity, and leadership. The items are derived from the research literature dealing with characteristics of gifted and creative persons. It should be pointed out that a considerable amount of individual differences can be found within this population: and therefore, the profiles are likely to vary a great deal. Each item in the scales should be considered separately and should reflect the degree to which you have observed the presence or absence of each characteristic. Since the four dimensions of the instrument represent relatively different sets of behaviors, the scores obtained from the separate scales should not be summed to yield a total score. Please read the statements carefully and place an X in the appropriate place according to the following scale of values:

1. If you have seldom or never observed this characteristic.
2. If you have observed this characteristic occasionally.
3. If you have observed this characteristic to a considerable degree.
4. If you have observed this characteristic almost all of the time.

Space has been provided following each item for your comments.

Scoring. Separate scores for each of the three dimensions may be obtained as follows:

.Add the total number of X's in each column to obtain the "Column Total."
.Multiply the Column Total by the "Weight" for each column to obtain the "Weighted Column Total."
.Sum the Weighted Column Totals across to obtain the "Score" for each dimension of the scale.
.Enter the Scores below.

Learning Characteristics....._____
Motivational Characteristics....._____
Creativity Characteristics....._____
Leadership Characteristics....._____

Part I: Learning Characteristics	1*	2	3	4
1. Has unusually advanced vocabulary for age or grade level: uses terms in a meaningful way: has verbal behavior characterized by "richness: of expression, elaboration, and fluency." (National Education Association, 1960; Terman & Oden, 1947; Witty, 1955)	_	_	_	_
2. Possesses a large storehouse of information about a variety of topics (beyond the usual interests of youngsters his age). (Ward, 1961; Terman, 1925; Witty, 1958)	_	_	_	_
3. Has quick mastery and recall of factual information. (Goodhart & Schmidt, 1940; Terman & Oden, 1947; National Education Association, 1960)	_	_	_	_
4. Has rapid insight into cause-effect relationships; tried to discover the how and why of things; asks many provocative questions (as distinct from informational or factual questions); wants to know what makes things (or people) "tick." (Carroll, 1940; Witty, 1958; Goodhart & Schmidt, 1940)	_	_	_	_
5. Has a ready grasp of underlying principles and can quickly make valid generalizations about events, people, and things (Bristow, 1951; Carroll, 1940; Ward, 1961)	_	_	_	_
6. Is a keen and alert observer; usually "sees more" or "gets more" out of a story, film, etc. than others (Witty, 1958; Carroll, 1940; National Education Association, 1960)	_	_	_	_
7. Reads a great deal on his own; usually prefers adult level books, does not avoid difficult material; may show a preference for biography, autobiography, encyclopedias, and atlases. (Hollingworth, 1942; Witty, 1958; Terman & Oden, 1947)	_	_	_	_
8. Tries to understand complicated material by separating it into its respective parts; reasons things out for himself; sees logical and common sense answers (Freehill, 1961; Ward, 1962; Strang, 1958)	_	_	_	_
Column Total	_	_	_	_
Weight	1	2	3	4
Weighted Column Total	_	_	_	_
Total				____

*1-Seldom or never
2-Occasionally
3-Considerably
4-Almost always

Part II: Motivational Characteristics

	1	2	3	4
1. Becomes absorbed and truly involved in certain topics or problems; is persistent in seeking task completion. (It is sometimes difficult to get him to move on to another topic.) (Freehill, 1961; Brandwain, 1955; Strang, 1958)	_	_	_	_
2. Is easily bored with routine tasks. (Ward, 1962; Terman & Oden, 1947; Ward, 1961)	_	_	_	_
3. Needs little external motivation to follow through in work that initially excites him. (Carroll, 1940; Ward, 1961; Villars, 1957)	_	_	_	_
4. Strives toward perfection; is self critical; is not easily satisfied with his own speed or products. (Strang, 1958; Freehill, 1961; Carroll, 1940)	_	_	_	_
5. Prefers to work independently; requires little direction from teachers. (Torrance, 1965; Gowan & Demos, 1964; Mokovic, 1953)	_	_	_	_
6. Is interested in many "adult" problems such as religion, politics, sex, race--more than usual for age level. (Witty, 1955; Ward, 1961; Chaffee, 1963)	_	_	_	_
7. Often is self assertive (sometimes even aggressive); stubborn in his beliefs. (Buhler & Guiri, 1963; Gowan & Demos, 1964; Ward, 1961)	_	_	_	_
8. Likes to organize and bring structure to things, people, and situations. (Ward, 1961; Gowan & Demos, 1964; Buhler & Guirl, 1963)	_	_	_	_
9. Is quite concerned with right and wrong, good and bad; often evaluates and passes judgment on events, people, and things. (Getzels & Jackson, 1962; Buhler & Guirl, 1963; Carroll, 1940)	_	_	_	_
Column Total	_	_	_	_
Weight	1	2	3	4
Weighted Column Total	_	_	_	_
Total				_____

Part III: Creativity Characteristics	1	2	3	4
1. Displays a great deal of curiosity about many things; is constantly asking questions about anything and everything. (National Education Association, 1960; Goodhart & Schmidt, 1940; Torrance, 1962)	_	_	_	_
2. Generates a large number of ideas or solutions to problems and questions; often offers unusual ("way out"), unique, clever responses. (Carroll, 1940; Hollingworth, 1942; National Education Association, 1960)	_	_	_	_
3. Is uninhibited in expressions of opinion; is sometimes radical and spirited in disagreement; is tenacious. (Torrance, 1965; Gowan & Demos, 1964; Getzels & Jackson, 1962)	_	_	_	_
4. Is a high risk taker; is adventurous and speculative. (Getzels & Jackson, 1962; Villars, 1957; Torrance, 1965)	_	_	_	_
5. Displays a good deal of intellectual playfulness; fantasizes; imagines ("I wonder what would happen if..."); manipulates ideas (i.e., changes, elaborates upon them); is often concerned with adapting, improving, and modifying institutions, objects and systems. (Rogers, 1959; Gowwan & Demos, 1964; Getzels & Jackson, 1962)	_	_	_	_
6. Displays a keen sense of humor and sees humor in situations that may not appear to be humorous to others. (Torrance, 1962; Gowan & Demos, 1964; Getzels & Jackson, 1962)	_	_	_	_
7. Is unusually aware of his impulses and more open to the irrational in himself (freer expression of feminine interest for boys, greater than usual amount of independence for girls); shows emotional sensitivity. (Torrance, 1962; Rothney & Coopman, 1958; Gowan & Demos, 1964)	_	_	_	_
8. Is sensitive to beauty; attends to aesthetic characteristics of things. (Wilson, 1965; Witty, 1958; Villars, 1957)	_	_	_	_
9. Is nonconforming; accepts disorder; is not interested in details; is individualistic; does not fear being different. (Carroll, 1940; Buhler & Guirl, 1963; Getzels & Jackson, 1962)	_	_	_	_
Column Total	_	_	_	_
Weight	1	2	3	4
Weighted Column Total	_	_	_	_
Total				____

Part IV: Leadership Characteristics	1	2	3	4
1. Carries responsibility well; can be counted on to do what he has promised and usually does it well. (Baldwin, 1932; Belingrath, 1930; Burks, 1938)	_	_	_	_
2. Is self confident with children his own age as well as adults; seems comfortable when asked to show his work to the class. (Drake, 1944; Cowley, 1931; Bellingrath, 1930)	_	_	_	_
3. Seems to be well liked by his classmates. (Bellingrath, 1930; Garrison, 1935; Zeleny, 1939)	_	_	_	_
4. Is cooperative with teacher and classmates; tends to avoid bickering and is generally easy to get along with. (Dunkerly, 1940; Newcomb, 1943; Fauquier & Gilchrist, 1942)	_	_	_	_
5. Can express himself well; has good verbal faculty and is usually well understood. (Simpson, 1938; Terman, 1904; Durks, 1938)	_	_	_	_
6. Adapts readily to new situations; is flexible in thought and action and does not seem disturbed when the normal routine is changed. (Eichler, 1934; Flemming, 1935; Caldwell, 1926)	_	_	_	_
7. Seems to enjoy being around other people; is sociable and prefers not to be alone. (Drake, 1944; Goodenough, 1930; Bonney, 1943)	_	_	_	_
8. Tends to dominate others when they are around, generally directs the activity in which he is involved. (Richardson & Hanswalt, 1943; Hunter & Jordan, 1939; Bowden, 1926)	_	_	_	_
9. Participates in most social activities connected with the school; can be counted on to be there if anyone is. (Zeleny, 1939; Link; 1944; Courtenay, 1938)	_	_	_	_
10. Excels in athletic activities; is well coordinated and enjoys all sorts of athletic games. (Flemming, 1935; Partridge, 1934; Spaulding, 1934)	_	_	_	_
Column Total	_	_	_	_
Weight	1	2	3	4
Weighted Column Total	_	_	_	_
Total				____

APPENDIX C

MEAN OF MATHEMATICS GRADES FROM 7TH GRADE TO PRESENT

MEAN GRADE	ABSOLUTE FREQUENCY
1.68	1
2.00	1
2.33	1
2.77	1
2.80	2
2.91	1
2.93	5
3.00	1
3.06	1
3.11	3
3.14	1
3.29	2
3.34	1
3.37	1
3.43	5
3.44	3
3.51	1
3.57	1
3.64	1
3.67	2
3.71	2

Appendix C (continued)

MEAN OF MATHEMATICS GRADES FROM 7TH GRADE TO PRESENT

MEAN GRADE	ABSOLUTE FREQUENCY
3.73	1
3.78	6
3.80	1
3.83	1
3.86	4
3.89	5
3.94	1
4.00	16

MEAN	3.531	STD ERR	.058	MEDIAN	3.710
MODE	4.000	STD DEV	.494	VARIANCE	.244
KURTOSIS	2.509	SKEWNESS	-1.447	RANGE	2.320
MINIMUM	1.680	MAXIMUM	4.000	SUM	254.210
C.V. PCT	13.988	.95 C.I.	3.415	TO	3.647

VALID CASES 72

APPENDIX D

SIXTH GRADE MATHEMATICS GRADES

GRADE	ABSOLUTE FREQUENCY
S(2.0)	1
G(3.0)	18
E(4.0)	47
Blank	6
TOTAL	72

MEAN	3.697	STD ERR	.061	MEDIAN	3.798
MODE	4.000	STD DEV	.495	VARIANCE	.245
KURTOSIS	.486	SKEWNESS	-1.264	RANGE	2.000
MINIMUM	2.000	MAXIMUM	4.000	SUM	244.000
C.V. PCT	13.395	.95 C.I.	3.575	TO	3.819

VALID CASES 66 MISSING CASES 6

APPENDIX E

IOWA TEST OF BASIC SKILLS

MATH TOTAL SCORE
(Percentiles)

SCORE	ABSOLUTE FREQUENCY
76.	1
78.	1
80.	1
81.	2
85.	2
86.	2
88.	2
90.	1
91.	5
93.	4
94.	4
95.	7
96.	3
97.	9
98.	7
99.	10
BLANK	11
TOTAL	72

Appendix E (continued)

MEAN	93.590	STD ERR	.738	MEDIAN	95.286
MODE	99.000	STD DEV	5.763	VARIANCE	33.213
KURTOSIS	1.379	SKEWNESS	99.000	SUM	5709.000
C.V. PCT	6.158	.95 C.I.	92.114	TO	95.066

VALID CASES 61 MISSING CASES 11

APPENDIX F

IOWA TEST OF BASIC SKILLS COMPOSITE

TEST TOTAL SCORE
(Percentiles)

SCORE	ABSOLUTE FREQUENCY
67.	1
70.	1
78.	1
81.	1
82.	5
83.	1
88.	2
89.	2
90.	3
92.	4
93.	4
94.	5
95.	4
96.	5
97.	6
98.	7
99.	8
BLANK	12
TOTAL	72

Appendix F (continued)

MEAN	92.383	STD ERR	.920	MEDIAN	94.500
MODE	99.000	STD DEV	7.124	VARIANCE	50.749
KURTOSIS	2.807	SKEWNESS	-1.661	RANGE	32.000
MINIMUM	67.000	MAXIMUM	99.000	SUM	5543.000
C.V. PCT	7.711	.95 C.I.	90.543	TO	94.224

VALID CASES 60 MISSING CASES 12

APPENDIX G

SAMPLE RAW DATA

CODE	AGE	GENDER	MATH 7-8 GRADE	ALG.	GEOM.	ADV. ALG.	TRIG/ AN	CALC.	MEAN MATH	STILL ACCEL.	SUCCESS
1	150	M	4.0	4.0	4.0	3.5	(4.0)	--	3.89	yes	3.80
2	137	F	4.0	3.5	4.0	3.5	(3.0)	--	3.67	yes	3.60
3	143	F	4.0	4.0	4.0	4.0	(4.0)	--	4.0	yes	4.00
4	135	F	4.0	4.0	4.0	4.0	3.0	(3.0)	3.73	yes	3.57
5	142	M	4.0	3.5	4.0	3.5	(4.0)	--	3.78	yes	3.80
6	138	F	4.0	3.5	4.0	3.5	(4.0)	--	3.78	yes	3.80
7	139	F	3.5	4.0	4.0	4.0	(4.0)	--	3.89	yes	4.00
8	140	M	4.0	4.0	4.0	4.0	(4.0)	--	4.00	yes	4.00
9	126	F	3.5	3.0	3.5	3.5	(4.0)	--	3.44	yes	3.60
10	147	F	4.0	3.5	4.0	4.0	(4.0)	--	3.89	yes	4.00
11	148	F	4.0	2.2	3.0	(3.0)	--	--	3.06	no	3.00
13	146	M	4.0	3.5	3.5	4.0	(4.0)	--	3.78	yes	3.80
14	143	F	3.5	4.0	(4.0)	(4.0)	--	--	3.80	no	4.00
15	133	M	1.5	3.2	3.0	(4.0)	--	--	2.77	no	3.33

Appendix G (continued)

Sample Raw Data

CODE	AGE	GENDER	MATH 7-8 GRADE	ALG.	GEOM.	ADV. ALG.	TRIG/ AN	CALC.	MEAN MATH	STILL ACCEL.	SUCCESS
16	141	M	3.5	2.7	3.5	(4.0)	--	--	3.34	no	3.67
17	145	F	3.5	2.5	3.0	3.5	(3.0)	--	3.11	yes	3.20
18	150	M	3.0	2.5	3.5	3.0	(3.0)	--	3.00	yes	3.20
19	142	F	--	3.0	4.0	4.0	(2.0)	--	3.43	yes	3.33
20	142	M	4.0	3.0	3.0	4.0	4.0	(4.0)	3.64	yes	3.71
21	142	F	4.0	4.0	4.0	4.0	(4.0)	--	4.00	yes	4.00
22	146	F	3.5	4.0	4.0	4.0	(4.0)	--	3.89	yes	4.00
23	143	M	4.0	4.0	4.0	3.5	(4.0)	--	3.89	yes	3.80
24	147	M	4.0	4.0	4.0	4.0	(4.0)	--	4.00	yes	4.00
25	140	M	1.0	2.5	(3.0)	--	--	--	2.00	yes	3.00
26	144	F	4.0	4.0	4.0	4.0	(4.0)	--	4.00	yes	4.00
27	146	F	4.0	4.0	4.0	4.0	(4.0)	--	4.00	yes	4.00
29	149	M	4.0	4.0	4.0	4.0	4.0	(4.0)	4.00	yes	4.00
30	143	M	3.0	3.0	(2.0)	--	--	--	2.80	no	2.00

Appendix G (continued)

Sample Raw Data

CODE	AGE	GENDER	MATH 7-8 GRADE	ALG.	GEOM.	ADV. ALG.	TRIG/ AN	CALC.	MEAN MATH	STILL ACCEL.	SUCCESS
31	140	F	4.0	4.0	4.0	(4.0)	--	--	4.00	yes	4.00
32	145	M	3.0	3.0	3.0	(3.0)	--	--	3.00	yes	3.00
33	138	F	3.5	2.5	3.0	(4.0)	--	--	3.14	yes	3.33
34	147	F	3.0	3.4	3.4	(4.0)	--	--	3.43	yes	3.67
35	146	M	3.5	3.5	4.0	4.0	(3.0)	--	3.67	yes	3.80
36	148	M	4.0	4.0	4.0	(4.0)	--	--	4.00	yes	4.00

	All 2 courses in 1 year	ACC School	Grade	Courses enrolled in	6th Grade math grade	Iowa Math	Iowa Test Total	Ident.	Sem. Math	Sem. School	Sem. math per sem. school
1	no	no	11	trig	3	95	90	yes	11	9	1.2
2	no	no	11	trig	4	93	92	yes	11	9	1.2
3	no	no	11	trig	4	98	98	yes	11	9	1.2
4	yes	no	11	calc	3	91	82	yes	13	9	1.4
5	no	no	11	trig	4	97	93	yes	11	9	1.2
6	no	no	11	trig	4	96	96	yes	11	9	1.2
7	no	no	11	trig	4	94	92	yes	11	9	1.2
8	no	no	11	trig	4	99	97	yes	11	9	1.2
9	no	no	11	trig	4	--	--	yes	11	9	1.2
10	no	no	11	trig	4	85	88	yes	11	9	1.2
11	no	no	11	advalg	2	91	89	yes	9	9	1.0
13	no	no	11	trig	4	94	--	yes	11	9	1.2
14	no	no	10	geom	4	94	97	yes	7	7	1.0
15	no	no	11	advalg	3	93	98	no	9	9	1.0
16	no	no	11	advalg	4	98	97	yes	9	9	1.0
17	no	no	11	trig	4	99	99	yes	11	9	1.2
18	no	no	11	trig	4	88	93	yes	11	9	1.2
19	no	no	11	trig	4	99	97	yes	11	9	1.2
20	yes	no	11	calc	-	--	--	yes	13	9	1.4
21	no	no	11	trig	4	95	93	yes	11	9	1.2
22	no	no	11	trig	4	97	94	yes	11	9	1.2

	All 2 courses in 1 year	ACC School	Grade	Courses enrolled in	6th Grade math grade	Iowa Math	Iowa Test Total	Ident.	Sem. Math	Sem. School	Sem. math per sem. school
23	no	no	11	trig	4	97	98	yes	11	9	1.2
24	no	no	11	trig	4	99	99	yes	11	9	1.2
25	no	no	10	geom	4	93	67	yes	7	7	1.0
26	no	no	11	trig	4	95	95	yes	11	9	1.2
27	no	no	11	trig	4	99	99	yes	11	9	1.2
29	no	yes	11	calc	4	97	94	yes	13	9	1.4
30	no	no	10	geom	4	--	--	yes	7	7	1.0
31	no	no	10	advalg	4	95	96	yes	9	7	1.3
32	no	no	10	advalg	3	--	--	yes	9	7	1.3
33	no	no	10	advalg	4	95	94	yes	9	7	1.3
34	no	no	10	advalg	4	91	89	yes	9	7	1.3
35	no	yes	10	trig	4	91	93	yes	11	7	1.5
36	no	no	10	advalg	-	--	--	yes	9	7	1.3

Code	Age	Gender	7-8 Math Grade	Algebra	Geometry	Adv. Algebra	Trig	Calculus	Math Grade 7-10. 11	Still Accelerated	Success
37	137	F	4.0	4.0	4.0	(3.0)	-	-	3.86	yes	3.67
39	141	F	4.0	4.0	4.0	(4.0)	-	-	4.00	yes	4.00
40	149	M	3.0	3.0	4.0	(4.0)	-	-	3.43	yes	4.00
41	144	F	4.0	3.5	4.0	(4.0)	-	-	3.86	yes	4.00
42	146	M	4.0	3.0	4.0	(4.0)	-	-	3.71	yes	4.00
43	146	F	3.0	3.5	2.7	(2.0)	-	-	2.91	yes	2.47
44	140	F	4.0	4.0	4.0	(4.0)	(4.0)	-	4.00	yes	4.00
46	148	M	3.0	3.0	2.5	3.0	(2.0)	-	3.14	yes	2.60
47	143	F	3.0	3.0	3.5	(3.0)	-	-	3.14	yes	3.33
48	143	M	4.0	3.0	4.0	(4.0)	-	-	3.71	yes	4.00
50	147	F	4.0	4.0	4.0	(4.0)	-	-	4.00	yes	4.00
52	137	F	4.0	4.0	4.0	(4.0)	-	-	4.00	yes	4.00
53	126	F	3.5	3.5	3.0	(4.0)	-	-	3.43	yes	3.33
54	140	F	3.0	2.5	(3.0)	-	-	-	2.80	no	3.00
55	143	M	4.0	4.0	4.0	4.0	(4.0)	-	4.00	yes	4.00
56	141	M	3.0	3.0	(3.0)	-	-	-	3.00	no	3.00
57	144	M	4.0	4.0	3.5	(4.0)	-	-	3.86	yes	3.67
58	147	M	4.0	3.5	4.0	(4.0)	-	-	3.86	yes	4.00
62	148	M	4.0	4.0	4.0	(4.0)	-	-	4.00	yes	4.00
63	146	F	4.0	4.0	4.0	(4.0)	-	-	4.00	yes	4.00
64	140	F	4.0	4.0	4.0	(4.0)	-	-	4.00	yes	4.00
66	144	M	3.8	4.0	4.0	(4.0)	-	-	3.94	yes	4.00
67	140	M	4.0	3.0	3.0	(3.0)	-	-	3.29	yes	3.00

Code	Age	Gender	7-8 Math Grade	Algebra	Geometry	Adv. Algebra	Trig.	Calculus	Math Grade 7-10. 11	Still Accelerated	Success
68	142	F	4.0	3.0	3.0	(3.0)	-	-	3.29	yes	3.00
70	142	M	4.0	3.0	3.5	(4.0)	-	-	3.57	yes	3.67
71	146	M	3.3	3.5	3.5	(4.0)	-	-	3.51	yes	3.67
72	146	M	3.8	3.0	3.0	(4.0)	-	-	3.37	yes	3.33
73	144	M	4.0	3.5	(4.0)	(4.0)	-	-	3.83	yes	4.00
74	147	M	3.0	2.5	3.5	(3.0)	-	-	3.00	yes	3.33
81	138	M	3.0	2.7	3.0	3.0	(3.0)	-	2.93	yes	3.00
82	146	M	3.5	4.0	4.0	3.5	(4.0)	-	3.78	yes	3.80
83	142	F	3.5	2.5	(3.0)	-	-	-	3.00	no	3.00
84	145	F	2.7	0.5	(2.0)	-	-	-	1.68	no	2.00
85	137	M	2.5	2.5	3.5	2.0	(0.0)	-	2.33	no	2.20
86	151	M	3.5	4.0	3.5	3.5	(4.0)	-	3.44	yes	3.60
88	146	M	4.0	3.5	4.0	3.5	(4.0)	-	3.78	yes	3.80
89	136	M	4.0	4.0	3.5	3.5	(3.0)	-	3.78	yes	3.40
90	139	M	3.5	3.0	3.5	3.5	(4.0)	-	3.44	yes	3.60

Code	All 2/1	All summer school	Grade	Course enrolled in	6th Grade math grade	Iowa Math	Iowa Test	Ident.	Sem. Math	Sem. School	Sem. Math/School
37	no	no	10	advalg	4	98	99	yes	9	7	1.3
39	no	no	10	advalg	-	--	--	yes	9	7	1.3
40	no	no	10	advalg	3	99	97	yes	9	7	1.3
41	no	no	10	advalg	4	86	90	yes	9	7	1.3
42	yes	no	10	advalg	-	--	--	yes	9	7	1.3
43	no	yes	10	advalg	4	97	99	yes	9	7	1.3
44	yes	no	10	trig	4	97	98	yes	10	7	1.4
46	yes	no	10	trig	3	97	98	yes	11	7	1.5
47	no	no	10	advalg	4	98	98	yes	9	7	1.3
48	no	no	10	advalg	4	98	97	yes	9	7	1.3
50	no	no	10	advalg	4	99	99	yes	9	7	1.3
52	no	no	10	advalg	4	98	95	yes	9	7	1.3
53	no	no	10	advalg	3	95	90	yes	9	7	1.3
54	no	no	10	geom	4	--	--	yes	7	7	1.0
55	yes	yes	10	trig	4	99	99	no	11	7	1.5
56	no	no	10	geom	4	93	96	yes	7	7	1.0
57	no	no	10	advalg	3	97	96	yes	9	7	1.3
58	no	no	10	advalg	4	97	83	yes	9	7	1.3
62	no	no	10	advalg	4	99	99	yes	9	7	1.3
63	yes	no	10	advalg	4	95	98	no	9	7	1.3
64	no	no	10	advalg	4	94	94	yes	9	7	1.3
66	no	yes	10	advalg	4	78	82	no	9	7	1.3
67	yes	no	10	advalg	4	--	--	no	9	7	1.3

continued

Code	All 2/1	All summer school	Grade	Course enrolled in	6th Grade math grade	Iowa Math	Iowa Test	Ident.	Sem. Math	Sem. School	Sem. Math/School
68	yes	no	10	advalg	3	85	82	no	9	7	1.3
70	no	yes	10	advalg	3	91	94	no	9	7	1.3
71	no	yes	10	advalg	3	91	92	no	9	7	1.3
72	no	yes	10	advalg	3	96	96	no	9	7	1.3
73	yes	no	10	advalg	4	99	95	no	9	7	1.3
74	no	yes	10	advalg	3	80	82	no	9	7	1.3
81	no	yes	11	trig	-	--	--	no	11	9	1.2
82	yes	no	11	trig	3	88	88	no	11	9	1.2
83	no	no	10	geom	3	98	95	yes	7	7	1.0
84	no	no	10	geom	4	90	81	yes	7	7	1.0
85	no	yes	11	trig	3	76	92	no	10	9	1.1
86	no	yes	11	trig	3	81	82	no	11	9	1.2
88	no	yes	11	trig	-	--	--	no	11	9	1.2
89	yes	no	11	trig	3	81	70	no	11	9	1.2
90	yes	no	11	trig	4	86	78	no	11	9	1.2

APPENDIX H

REYNOLDS MATH SCALE

For purposes of this scale, math will be defined as the material covered in your math class at school.

DIRECTIONS: In the space provided, write the number of the response which best describes you in each of the following statements.

(5) very much like me

(4) like me

(3) undecided

(2) unlike me

(1) very much unlike me

EXAMPLE: _____ I come to class with my math homework completed.

_____	very much like me	if you come to class with your math homework completed on a regular basis
_____	like me	if you come to class with your math homework completed most of the time
_____	undecided	if you complete your homework about half the time
_____	unlike me	if you rarely complete your math homework for class
_____	very much unlike me	if you do not complete your math homework

Appendix H (continued)

Reynolds Math Scale 95

(-) _____1. Math is one of my hardest subjects.

_____2. I like to find different ways of getting an answer in math.

(-) _____3. Math formulas frighten me

(-) _____4. I would not like to have a career that requires using lots of math.

(-) _____5. I don't think that I should have to do math homework on the weekends.

_____6. If it were possible I would take 2 periods of math every day.

_____7. The farther along I get in math, the more fun it becomes.

(-) _____8. I would not like to enter a math contest.

(-) _____9. My favorite part of the school day is eating lunch with my friends.

____10. I seem to understand new math concepts and methods quicker than many of my classmates.

(-) ____11. I do not enjoy working with numbers.

(-) ____12. If my math homework takes longer than 45 minutes, I leave it unfinished.

____13. I think it is important to learn the metric system.

____14. I like to work hard on my school studies.

(-) ____15. My math teacher moves on to the next section before I understand the present lesson.

____16. I like math classes that are hard and require at least one hour of homework each night.

(-) ____17. I would rather write an essay than work math problems.

____18. The time seems to go quickly for me in math class.

(-) ____19. I believe that the learning of math has become less important since the invention of calculators.

(-) ____20. Math isn't hard for me, but I prefer studying other subjects.